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A review of the dictyopterine net-winged beetle genus *Punicealis* Kazantsev, 1990 (Coleoptera, Lycidae, Erotinae)

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Abstract

The dictyopterine net-winged beetle genus *Punicealis* Kazantsev, 1990 is re-described and reviewed. The external female genitalia of four of its six species are studied for the first time. Colour photographs of the habitus of all *Punicealis* species and details of their morphology, including photos of the male and female copulatory organs, are presented. An identification key to all *Punicealis* species is provided.

Key Words

Coleoptera, Dictyopterini, Erotinae, Holarctic, key, Lycidae, *Punicealis*

Introduction

The net-winged beetle taxon *Punicealis* Kazantsev, 1990 (Dictyopterini, Erotinae) was established as a subgenus of *Dictyoptera* Latreille, 1829, with *D.* (*Punicealis*) *medvedevi* Kazantsev, 1990 as the type species. Five species were initially included in the subgenus, three from the Far East of Russia and Japan and two from North America (Kazantsev 1990). *Punicealis* was differentiated from the nominative subgenus by the uniform elytral pubescence (confined to the elytral ribs in *Dictyoptera*) and conspicuously elongated hind trochanters, especially in the males (vs. short hind male trochanters in *Dictyoptera*). The four species transferred to *Punicealis* had been members of three different genera of the tribe, *Dictyoptera*, *Pyropterus* Mulsant, 1828 and *Eros* Newman, 1838 (Kleine 1933; Green 1951; Medvedev 1966).

A sixth species from the Himalayas was added to the subgenus shortly afterwards (Kazantsev 1993b) and a decade later, after a morphology-based phylogenetic analysis of the tribe Dictyopterini, the status of *Punicealis* was raised to the genus level (Kazantsev 2004, 2012a). The currently available molecular data suggest that the initial separation of the *Punicealis* clade occurred at an early stage of divergence amongst the dictyopterine lineages (Motyka et al. 2023a, 2023b). A closer look at the morphology of *Punicealis* species may also prove to be useful, as even seemingly minor morphological differences amongst the members of the genus may turn out to reflect independent development for millions of years (Motyka et al. 2022; Kazantsev et al. 2023).

The six now recognised *Punicealis* species are mostly hard to find in nature and seldom met in museum collections – one species, the Himalayan *P. martensi* Kazantsev, 1993 is known only by the holotype; the far-eastern *P. barovskii* (Medvedev 1966) – just by three specimens; another far-eastern endemic *P. miranda* Barovskij, 1930 – by not much more than a dozen specimens; *P. munda* from the eastern USA appears to be almost equally rare (Green 1951). Little is known about their biology and their larvae remain unknown (Bocak and Matsuda 2003; Kazantsev and Nikitsky 2011).

The present paper is a further contribution to the knowledge of *Punicealis*. Colour photographs of the habitus of its species and details of their morphology, including photos of the male and female copulatory organs, are presented for the first time. It is also the first time that their external female genitalia have been studied. An identification key to all *Punicealis* species is provided.

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Material and methods

For examination, the beetles were relaxed in water, then their detached abdomens were kept for up to 12 hours in 10% potassium hydroxide (KOH) at room temperature. The KOH-treated aedeagi and terminalia were then placed in microvials with glycerine for photographing and for permanent preservation. Terminology follows Bocak and Bocakova (1990) and Kazantsev (2005).

A MSP–1 zoom stereoscopic dissecting microscope with 8–80 times magnification range was used for examination of diagnostic characters. Photographs were taken with a Canon EOS 6D camera and Canon MP–E 65 mm lens. Images were then stacked using Zerene Stacker version 1.04 and enhanced in Adobe Photoshop Elements 9.

The following acronyms are used in the paper: **ICM** – Insect Centre, Moscow; **LSAM** – Louisiana State Arthropod Museum, Baton-Rouge; **MNS** – Museum für Naturkunde, Stuttgart; **ZIN** – Zoological Institute, St-Petersburg; **ZMMU** – Zoological Museum of Moscow University.

Results

Family Lycidae Laporte, 1838
Subfamily Erotinae LeConte, 1881
Tribe Dictyopterini Houlbert, 1922

Genus *Punicealis* Kazantsev, 1990

Type species. *Dictyoptera* (*Punicealis*) *medvedevi* Kazantsev, 1990 (original designation).

Diagnosis. *Punicealis*, being similar to *Dictyoptera*, due to its four primary elytral costae and double rows of cells in the elytral interstices, is readily distinguishable by the combination of the uniform elytral pubescence, with the bottom of cells as pubescent as the elytral costae and conspicuously elongate and distally acute hind trochanters (Figs 1, 3–5A, B) (only elytral costae are pubescent and hind trochanters are of regular shape in *Dictyoptera*).

Re-description. Male. Upperside red; pronotum at disc, scutellum and abdomen often infuscated (Fig. 1).

Head transverse. Eyes small, interocular distance noticeably greater than eye diameter. Labrum small, transverse, convex anteriorly. Palps short; ultimate palpomeres elongate, almost parallel-sided, only slightly widening distally, apically flattened and glabrous. Antennal sockets separated by moderately wide lamina. Antennae moderately long, reaching over mid-elytra, filiform, except conical and widening distally antennomeres 2 and 3; antennomeres 2 and 3 subequal in length and considerably shorter than antennomere 4, antennomeres 4–11 with relatively long erect pubescence (Figs 1, 3).

Pronotum transverse, in most cases convex anteriorly, with acute posterior and blunt anterior angles; median cell rhomboidal, with slightly concave posterior sides. Scutellum with minute emargination distally (Fig. 2).

Elytra long, slightly widening distally, non-dehiscent at suture, with four complete longitudinal costae and double rows of small regular sub-rectangular cells in the interstices; pubescence uniform, short, dense and sub-erect (Fig. 1).

Legs moderately long; hind trochanters noticeably longer than wide, prolonged and, in most cases, spinose at hind angle; hind femurs often stout and noticeably shorter than hind tibiae, hind tibiae narrow and straight (Fig. 3).

Aedeagus elongate, oval in dorsoventral view, with elongate, straight, relatively narrow, in dorsoventral view and slightly curved distally, in lateral view, median lobe; parameres slightly shorter than median lobe, open ventrally and proximally fused dorsally, with prominent inwardly directed tooth; phallobase, in dorsoventral view, elongate, oval, without median suture (Fig. 7).

Female. More robust than males, with relatively broader pronotum and elytra, somewhat stouter and shorter antennae; hind trochanters less elongate (Figs 4, 5A, B). Ultimate ventrite (sternite 8) with narrow spiculum ventrale, subequal in length to the sternite proper (Fig. 5C–E). External genitalia with elongate styli, elongate parallel-side coxites and long narrow valvifers; valvifers distally loosely connected to elongate bullet-shaped sternite 10; apices of styli and coxites with elongate erect setae (Fig. 6).

Distribution. Eastern Nepal, East Asia, North America.

Remarks. The species initially attributed to *Punicealis* were listed with names in masculine (Kazantsev 1993b), whereas they should have been coordinated in gender with the genus (which was *Dictyoptera*, feminine), not with the subgenus (e.g. Kazantsev (2025)). This renders the initial gender designation inapplicable. Later, when the status of *Punicealis* was raised, all the names of its species represented by an adjective were explicitly considered to be feminine (Kazantsev 2004, 2012a).

Punicealis barovskii (Medvedev, 1966)

Figs 1F, 2F, 3E, 7I, J

Type material. *Holotype*: **Russia:** • ♀, "Kunashir, env. Alekhino, mixed forest (Konovalova)', 'Holotype / *Pyropterus barovskii* sp. n. / L. Medvedev des.' (ZIN).

Additional material. Russia: • ♀, 'S. Kurils, Kunashir, env. Sernovodsk, 12–16.VI.[19]76, Anufriev'; • ♂, 'Sakhalin, Gornozavodsk, 25.V.1985, M. Danilevsky leg.' (ICM).

Distribution. Far East of Russia (Sakhalin and Kurils).

Biology. Mixed forest.

Remarks. To date, only three specimens of *P. barovskii* are known.

Punicealis hamata (Mannerheim, 1843)

Figs 1A, 2A, 3A, 4A, B, 6A, 7A, B

Type material. USA: • ♂, 'America bor., Sitka Ins.', '*Punicealis hamata* (Mnnh.) / S. Kazantsev det. 2001' (ZIN); • ♂ and ♀, 'Graham, Ore[gon], 4.4.[19]42, Douglas fir stump, H.J. Ostlind leg.', '*Punicealis hamata* (Mnnh.) / S. Kazantsev det. 2001' (ICM).

Distribution. North-western North America (from Alaska to Washington and Idaho) (Green 1951).

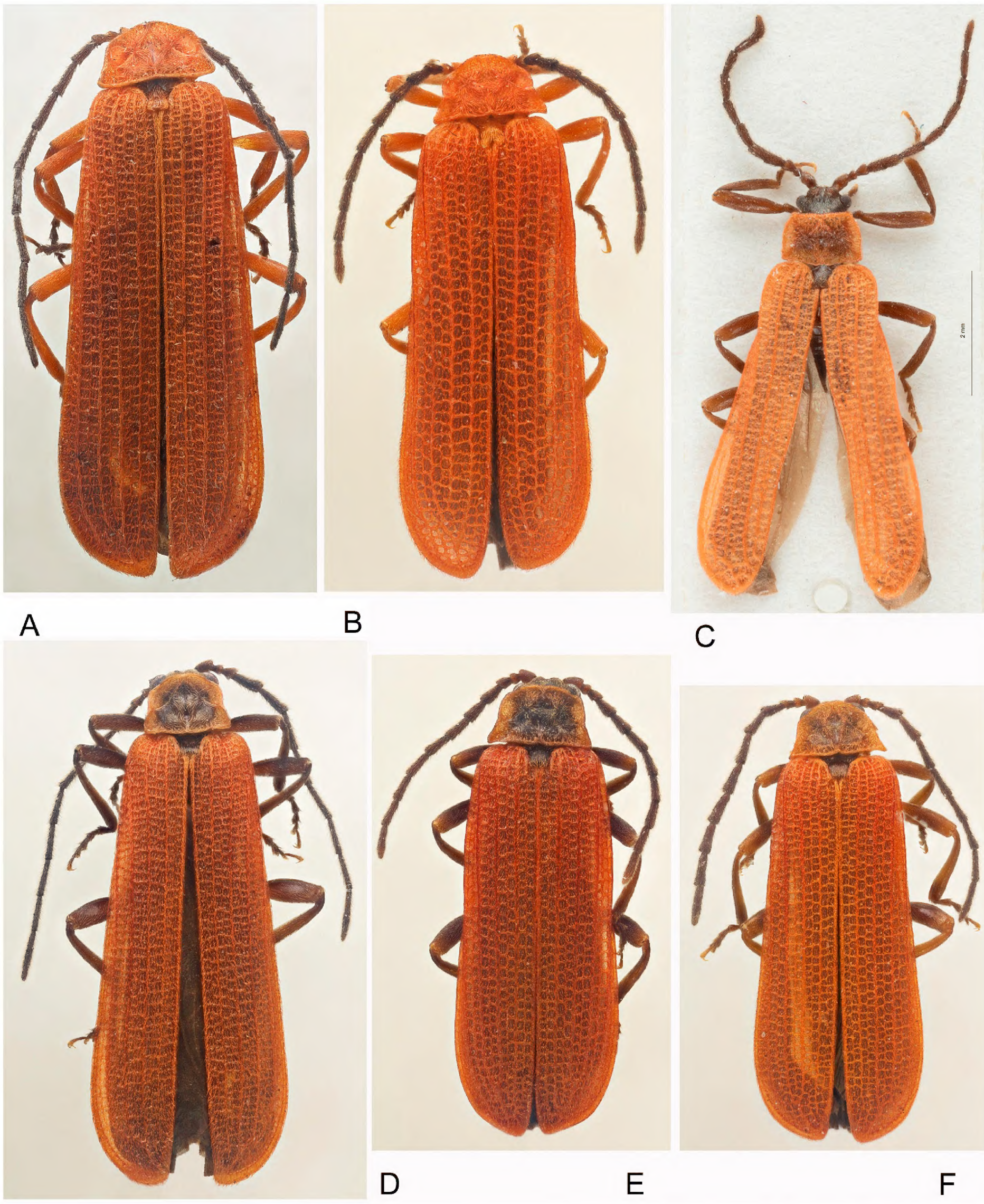

Figure 1. General view of *Punicealis* species, dorsally, males. **A.** *P. hamata*; **B.** *P. munda*; **C.** *P. martensi*, holotype; **D.** *P. medvedevi*; **E.** *P. miranda*; **F.** *P. barovskii*.

Biology. Adults in April through July (Green 1951).

Punicealis martensi Kazantsev, 1993

Figs 1C, 2C

Type material. ***Holotype*: Nepal:** • ♂, 'Nepal-Expeditionen Jochen Martens, 390, Sankhua Sabla Distr., Thudam, mixed forest, mainly Betula/Rhododendron, 3550–3650 m a.s.l., 25–27.V.1988, J. MARTENS & W. SCHAWALLER', 'Holotype / *Dictyoptera* (*Punicealis*) *martensi* sp. n. / S Kazantsev des. 1993' (MNS).

Distribution. North-eastern Nepal, Sankhua Sabla District, Thudam (Kazantsev 1993b).

Biology. Mixed forest with *Betula* and *Rhododendron*, 3550–3650 m above sea level.

Figure 2. Pronotum of *Punicealis* species, males. **A.** *P. hamata*; **B.** *P. munda*; **C.** *P. martensi*, holotype; **D.** *P. medvedevi*; **E.** *P. miranda*; **F.** *P. barovskii*.

Remarks. The illustration of aedeagus of *P. martensi* given in the description (Kazantsev 1993b: fig. 29) was based on a dried and non-KOH treated piece.

Punicealis medvedevi Kazantsev, 1990

Figs 1D, 2D, 3C, 4C, D, 5D, 6C, 7E, F

Type material. ***Holotype*: Russia:** • ♂, 'Kunashir Is., Mendeleevo, 14.VII.1985 (V. Belov)', 'Holotype / *Dictyoptera* (*Punicealis*) *medvedevi* sp. n. / S Kazantsev des. 1990' (ZMMU). ***Paratype*: Russia:** • ♂, 'Anikin Kordon, Maihe R., Primorskij Krai, 15.V.1961 (E. Regel) 'Paratype / *Dictyoptera* (*Punicealis*) *medvedevi* sp. n. / S Kazantsev des. 1990' (ZIN).

Additional material. Russia: • ♂, 'Russia, Far East, Maritime Territory., Peishula, Shkotovo distr., 2.VI.1974, V. Kuznetsov leg.'; • ♂ and ♀, 'FE Russia: Kunashir Is., Mendeleevo, 23.VI.1985, S. Saluk'; • ♂, 'FE Russia: Kunashir Is., 17 km SW Yuzhno-Kurilsk,

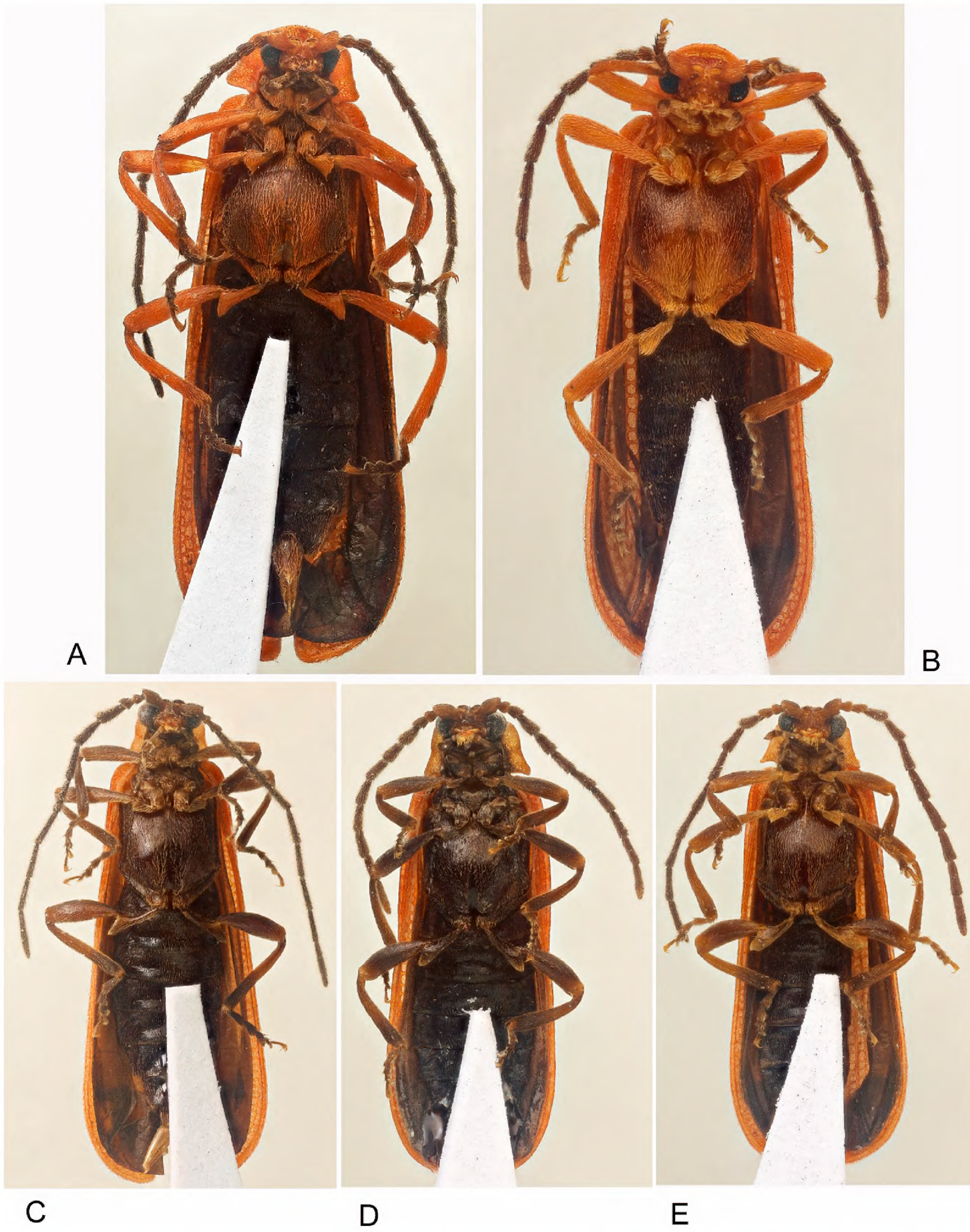

Figure 3. General view of *Punicealis* species, ventrally, males. **A.** *P. hamata*; **B.** *P. munda*; **C.** *P. medvedevi*; **D.** *P. miranda*; **E.** *P. barovskii*.

4.VII.1985, S. Saluk'; • ♀, 'S Primorje (Ussuri), env. Gorno-Tajozhnoe, 20.VI.1989, Kurbatov'; • 2 ♀♀, 'Kuriles, SW Kunashir Is., 16–21.VII.1989, S. Kurbatov'; • ♂ and 2 ♀♀, 'S Primorje (Ussuri), 50 km E Ussurijsk, upper Artemovka R., 7–8.VI.1990, S. Kazantsev leg.'; • ♂, 'SW Kunashir, env. Tretjakovo, 2.VII.1991, S. Kurbatov'; • ♀, 'FE Russia: Kurils, Kunashir, Valentiny Lake, 27.VI.2008, I. Melnik'; • ♂, 'Shikotan, env. Tserkovnaya Bay, 13–14.VII.2012, Yu. Sundukov'; • ♂, 'FE Russia: Kunashir Is., Stolbovskaya Tropa Trail, 3.VII.2013, Yu. Sundukov leg.'; • ♂, 'FE Russia: Sikhote-Alin' Res., upper Dzhigitovka R., Kabanij Spring, 27.VI.2015, M. Sergeev leg.'; **Japan:** • ♂, [Shikoku], Mt. Ishizuchi, Ehime, 10.VI.1991, M. Siraishi'; • ♂, 'Japan: Honshu, Aichi Prefecture., Mennoki Pass, Inabu-Cho, 11.V.1999, Lee leg.' (ICM).

Distribution. Far East Russia (south of Primorskij Kraj and the Kuril Islands of Kunashir and Shikotan), Japan (Hokkaido, Honshu, Shikoku, Kyushu) (Nakane 1969; Kazantsev 2012b).

Biology. Individuals of this species inhabit mixed broadleaf and coniferous forests. In Japan, *P. medvedevi*

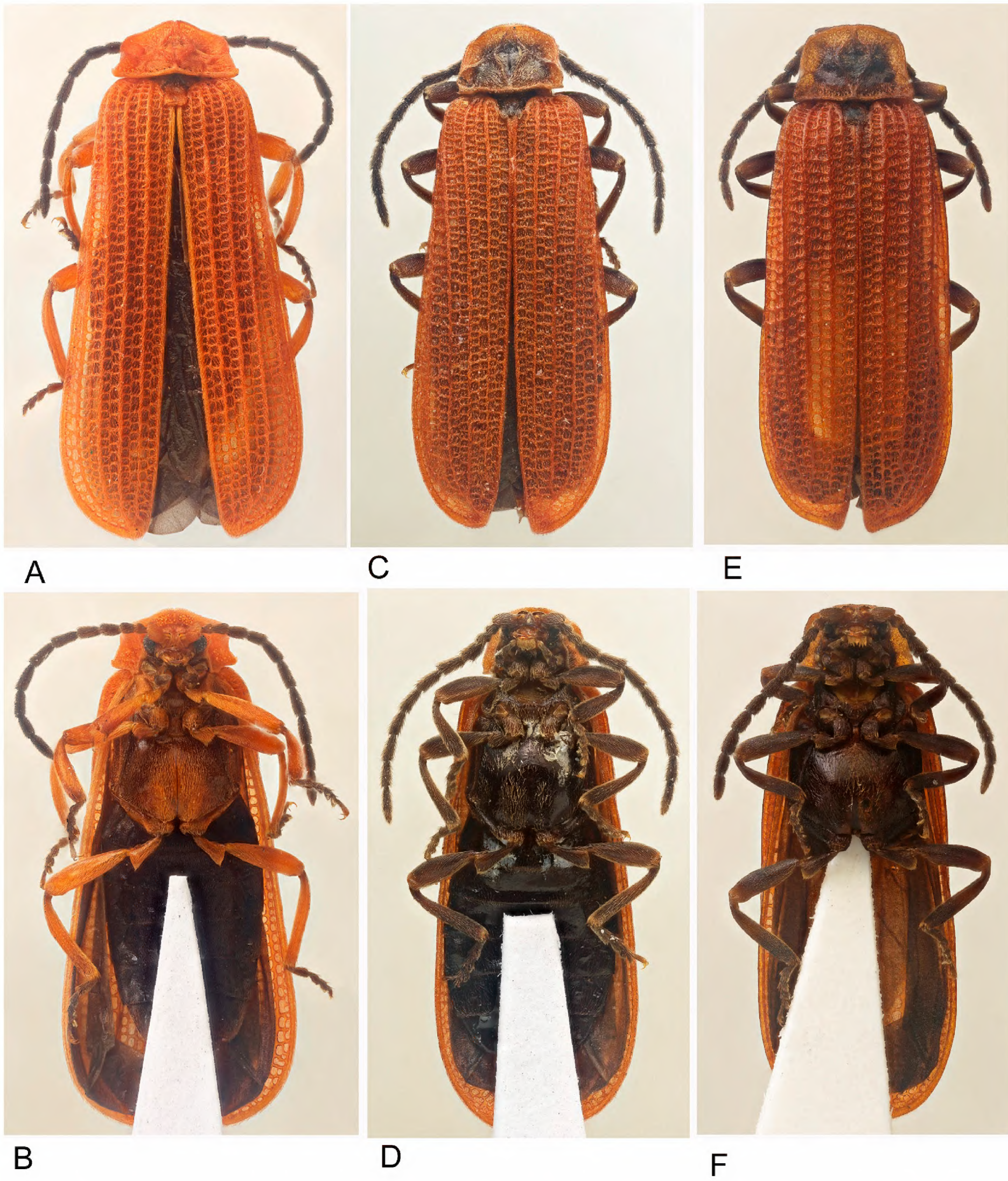

Figure 4. General view of *Punicealis* species, females: **A, B.** *P. hamata*; **C, D.** *P. medvedevi*; **E, F.** *P. miranda*. **A, C, E.** Dorsally; **B, D, F.** Ventrally.

seems to be confined to mountain forest, for example, on the slopes of Mt. Ishizuchi, the summit of which towers over the surrounding landscape at 1,982 m a.s.l., Mt. Amagi (Nakane 1969), the summit of which is over 1,300 m a.s.l. or in Mennoki Pass, at 1,100 m a.s.l., whereas in the Russian Far East, both in the continental southern Primorskij Krai and the southern Kuril Islands, the species has been collected at altitudes from just slightly over 100 m a.s.l to several hundred metres. In Japan, its adults emerge in May – early June, while in the Russian Far East, they are registered in June through July, apparently due to a later spring.

Remarks. This species was erroneously referred to as *Dictyoptera oculata* (Gorham, 1883) in the revisional work on the net-winged beetle fauna of Japan (Nakane 1969). An examination of the type of *Eros oculatus* Gorham from the Natural History Museum (London), however, made it clear that it is different from *D. oculata* sensu Nakane 1969, the two species not even belonging in a single genus (Kazantsev 1993a).

Figure 5. General view and ultimate abdominal sternite of *Punicealis* species, females. **A–C.** *P. munda*; **D.** *P. medvedevi*; **E.** *P. miranda*. **A, B.** General view; **C–E.** Ultimate abdominal sternite; **A, C–E.** Dorsally; **B.** Ventrally. Scale bars: 0.5 mm.

Punicealis miranda (Barovskij, 1930)

Figs 1E, 2E, 3D, 4E, F, 5E, 6D, 7G, H

Type material. ***Paratype*: Russia:** • ♂, 'Primorsk obl., Ulahe R., 25.V.1912, V.K. Arsenjev leg.', '*Dictyoptera miranda* m. / Cotype / W. Barovsky det.' (Barovskij's manuscript label) (ZIN).

Additional material. Russia: • ♀, 'Ussurijskij Kraj, southern slopes of Sikhote-Alin', 9.V.1929, N. Fillipov leg.'; • ♂ and ♀, 'S Primorje (Ussuri), env. Kamenushka, 3.VI.1989, S. Kurbatov leg.'; • ♂, 'S Primorje (Ussuri), 50 km E Ussurijsk, upper Artemovka R., 7–8.VI.1990, S. Kazantsev leg.' (ICM).

Distribution. Far East of Russia (south of Primorskij Kraj) (Kazantsev 2012b).

Biology. Mixed broadleaf and coniferous forest. Adults in May–June.

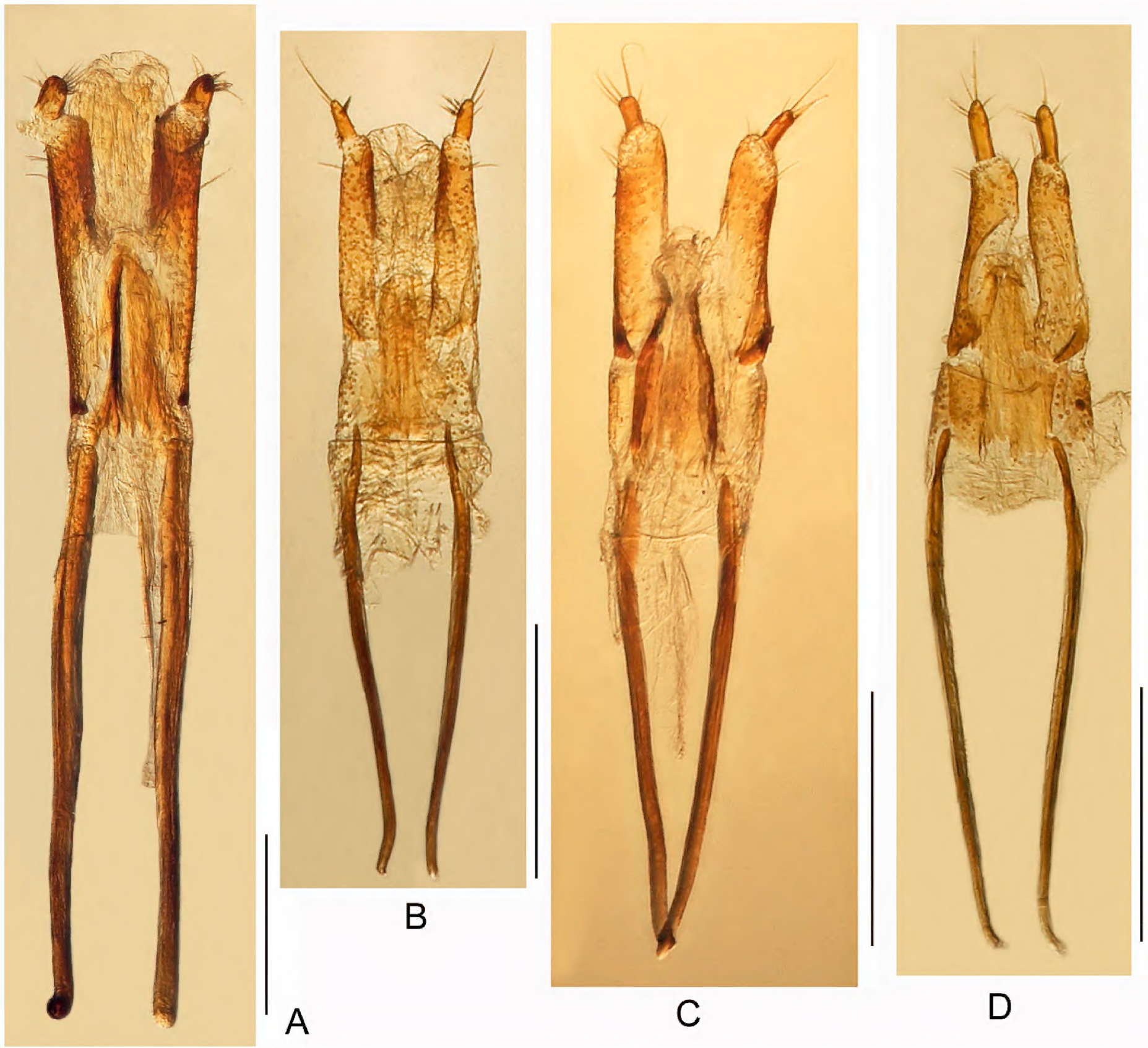

Figure 6. External female genitalia of *Punicealis* species: **A.** *P. hamata*; **B.** *P. munda*; **C.** *P. medvedevi*; **D.** *P. miranda*. Scale bars: 0.5 mm.

Punicealis munda (Say, 1835)

Figs 1B, 2B, 3B, 5A–C, 6B, 7C, D

Type material. USA: • ♂ and 2♀♀, 'USA: TN, Great Smokey Mts N.P., Whiteoak Sink, 600 m a.s.l., sweeping, 4–10.VI.2005, S. Kazantsev leg.' (ICM and LSAM).

Distribution. Eastern USA (from Pennsylvania and southern Illinois to Georgia and Louisiana) (Green 1951).

Biology. Imagines in June–July; hibernating specimens were found in Illinois in February in a log (Green 1951).

Remarks. Green (1951) also indicates *P. munda* for Arizona (Tucson), but this needs confirmation, as Arizona, lying in the west of the USA, is rather far away from the main distribution area of the species.

Key to *Punicealis* species

1 Pronotum uniformly red (Figs 1A, B, 3A, B, 4A, B, 5A, B) (North American species) 2
– Pronotum bicolorous, red with infuscated disc (Figs 1C–F, 3C–E, 4C–F) (Asian species) 3
2 Large, 10–15 mm in length (Fig. 1A); apices of male hind trochanters elongated and acute (Fig. 3A). Phallobase narrow, ca. 2.4 times longer than wide (Fig. 7A); styli short, only slightly longer than wide (Fig. 6A)..... *P. hamata* (Mannerheim, 1843)
– Small, not more than 6 mm in length (Fig. 1B); apices of male hind trochanters not elongated, rounded (Fig. 3B); phallobase relatively broad, ca. 1.4 times longer than wide (Fig. 7C); styli elongate (Fig. 6C) ..... *P. munda* (Say, 1835)

3 Anterior pronotal margin almost straight; elytral costa 2 noticeably stouter than costa 1 in distal two-thirds (Figs 1C, 2C) ..... *P. martensi* Kazantsev, 1993
– Anterior pronotal margin noticeably convex; elytral costa 2 not different from costa 1 in most of its length (Figs 1D–F, 2D–F) 4
4 Body more elongate, male elytra 4 times longer than wide at humeri (Fig. 1D); parameres of aedeagus with rounded inner tooth in their middle (Fig. 7E) ..... *P. medvedevi* Kazantsev, 1990
– Body more robust, male elytra ca. 3 times longer than wide at humeri (Fig. 1E, F); parameres of aedeagus with acute inner tooth near apex (Fig. 7G–J) 5
5 Median pronotal cell roundish; elytral costae stouter (Figs 1E, 2E); middle trochanters distally rounded (Fig. 3D) ..... *P. miranda* (Barovskij, 1930)
– Median pronotal cell rhomboidal; elytral costae weaker (Figs 1F, 2F); middle trochanters distally pointed (Fig. 3E) ..... *P. barovskii* (Medvedev, 1966)

Discussion

The distribution pattern of *Punicealis* with one patch in the Far East of Asia (plus a location in the Himalayas) and another two patches in North America is very unlike most lycid genera, but resembles that of some of the other members of the subfamily Erotinae. A similar Holarctic distribution is characteristic of *Dictyoptera* (also from Dictyopterini) and *Erotides* Waterhouse, 1879 and *Lopheros* Leconte, 1881 (from Erotini) – however, in these genera, unlike in *Punicealis*, their Palaearctic patch extends deep into the West, actually to the Atlantic coast (Bocakova and Bocak 2007; Matsuda 2010; Kazantsev 2012a).

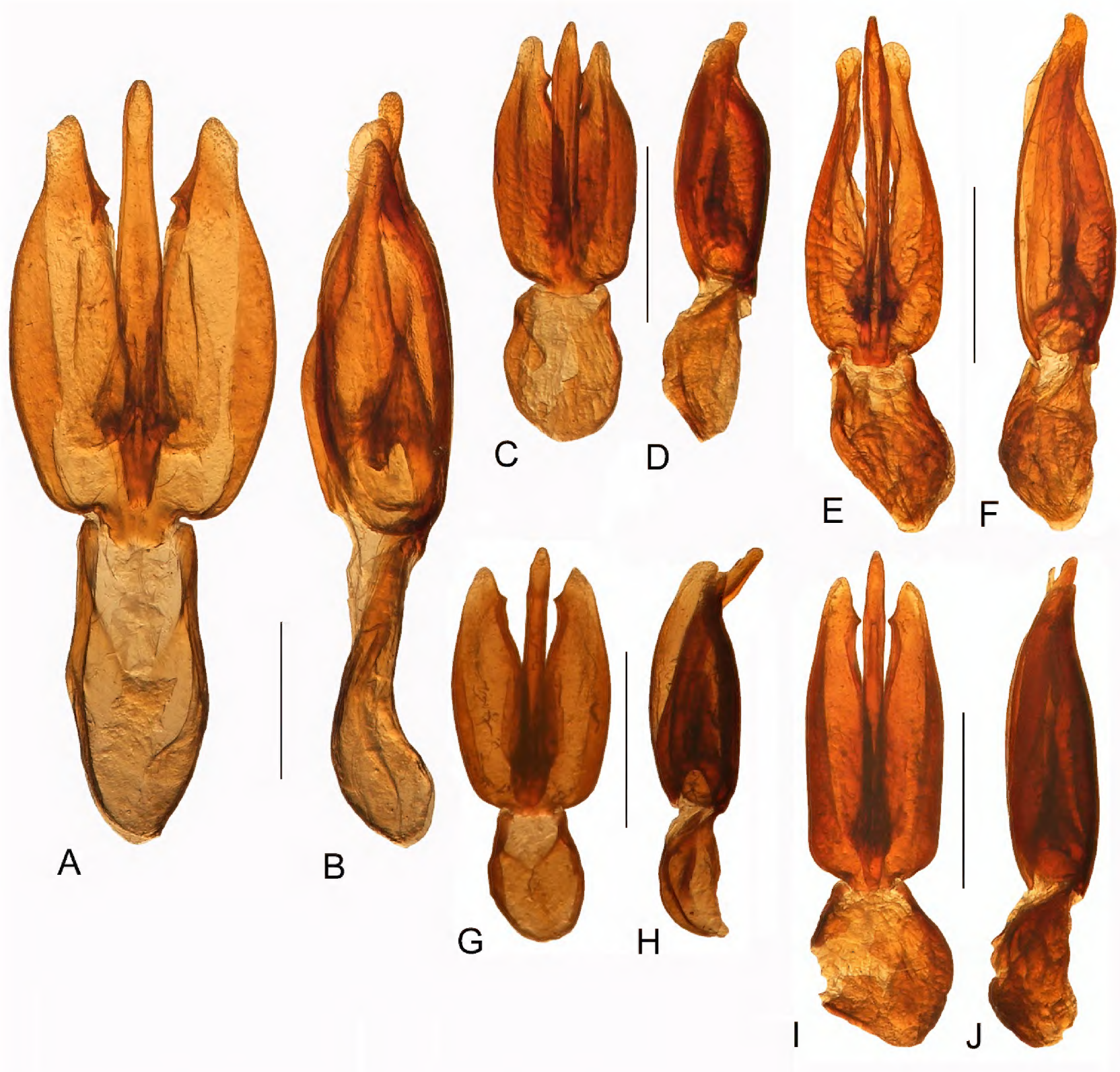

Figure 7. Aedeagus of *Punicealis* species. **A, B.** *P. hamata*; **C, D.** *P. munda*; **E, F.** *P. medvedevi*; **G, H.** *P. miranda*; **I, J.** *P. barovskii*; **A, C, E, G, I.** Dorsally; **B, D, F, H, J.** Ventrally. Scale bars: 0.5 mm.

The *Punicealis* species are easily differentiated from other dictyopterines by their uniform elytral pubescence and elongate and oblong distally hind male trochanters and are equally easily identified to species level, without any dissection and examination of their genitalia. On the other hand, they are remarkably uniform in their general morphology, despite there often being considerable gaps between their distribution patches.

However, certain potentially important morphological characters for phylogenetic purposes that distinguish some of the species do exist. In one of the species, *P. miranda*, the median pronotal areole is not rhomboidal like in others, but roundish (Fig. 2E). In *P. martensi*, the anterior pronotal margin is not convex as in other species, but truncate (Fig. 2C). In *P. munda*, the apices of male hind trochanters are not as elongated and acute as in all the other species, but relatively short and rounded, as in the female (Fig. 3B). In *P. medvedevi*, the parameres of aedeagus are provided not with an acute inward directed tooth near apex as in other species, but with a rounded inward directed tooth in their middle (Fig. 7E). In *P. hamata*, the styli of the external female genitalia are not distinctly elongate as in the congeners, but short, only slightly longer than wide (Fig. 6A). Notably, of all of these mentioned morphological peculiarities, none is manifest in more than one of the *Punicealis* species, which effectively precludes substantiated singling out of any species group in the genus, at the current level of knowledge.

Further studies, however, especially based on molecular analyses, may change this and some of the mentioned morphologies may actually turn out to support separation of a lineage within *Punicealis*, as was the case with erecting the dictyopterine genus *Gomezzuritus* Kazantsev, Motyka & Bocak, 2023 from within *Benibotarus* Kôno, 1932 (Kazantsev et al. 2023).

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